REMARKS

The Examiner's Final Office Action of April 17, 2003 has been received and its contents reviewed. Applicants would like to thank the Examiner for the consideration given to the above-identified application.

Claims 1-8, and 10 were pending in the present application prior to this Amendment. Claim 9 has been canceled. By this Amendment, claim 1 has been amended, and new claim 11 added. Accordingly, claims 1-8, and 10-11 are pending for consideration, of which claim 1 is independent. In view of these actions and the following remarks, reconsideration of this application is now requested.

Referring to the detailed Office Action, claim 1 is rejected under 35 U.S.C. §112 first and second paragraphs, as containing subject matter which is not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention, and as indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regards as the invention. Specifically, the Examiner contends that the feature of a base layer containing an impurity of a first conductor type is not shown in the specification and Figs. 1 and 8. In response, Applicants respectfully submit that the amendment of claim 1 in the Amendment filed February 4, 2003 erroneously and inadvertently included the phrase "a base layer containing an impurity of a first conductivity type" in the preamble. Applicants note that only the underlined text in the Marked Up Version of claim 1 was supposed to be amended, and that the original claim 1 does not recite the unintended feature. To correct this error, in case the unintended claim amended has been entered, Applicants have amended claim 1, as shown above, to delete the phrase "a base layer containing an impurity of a first conductivity type."

Claims 1-6, 8, and 10 stand rejected under 35 U.S.C. §103(a) as unpatentable over Jorke (U.S. Patent No. 5,798,539 – hereafter Jorke) in view of Yamazaki (U.S. Patent No. 5,440,152 – hereafter Yamazaki). Further, claim 7 is rejected under 35 U.S.C. 103(a) as unpatentable over Jorke, modified by Swanson et al. (U.S. Patent No. 6,362,065 – hereafter Swanson) as applied to claim 1 above, and further in view of S.M. Sze (Physics of Semiconductor Device, 2nd Edition, 1981 – hereafter Sze).

As amended, claim 1 further recites the emitter layer as having at least two semiconductor layers, and a high-concentration doped layer is interposed between the at least

two semiconductor layers. Support for the amendment of claim 1 can be found at least in, e.g., Fig. 8, and lines 13-21 of page 11 of the specification. To further clarify Fig. 8, Applicants are submitting herewith an attached Fig. 8 with emitter layer 5 shown with the at least two semiconductor layers which are labeled as 5a and 5b.

New claim 11, which depends from claim 1, recite the distance between the high-concentration doped layer and a base layer is 40 nm or less. Support for new claim 11 can be found at least in, e.g., page 36, lines 18-20 of the present specification.

According to the presently claimed invention, the emitter layer (5) is composed of at least two semiconductor layers (5a and 5b), and the high-concentration doped layer (11) is interposed between the two semiconductor layers (5a and 5b). Accordingly, as shown in Fig. 9, the high-concentration doped layer (11) becomes a barrier for the holes and reverse injection of the holes in the base to the emitter can be prevented.

Moreover, as shown in the attached Fig. A illustrating a band graph, which is based on Fig. 9 and is submitted herewith to explain the presently claimed invention, if the distance between the high-concentration doped layer (11) and the base layer (4) is more than 40 nm, the high-concentration doped layer (11) fails to become a barrier that prevents reverse injection of the holes in the base, and the holes and electrons recombine in the region near the connection of the emitter and the base.

Hence, if the distance between the high-concentration doped layer (11) and the base layer (4) is 40 nm or less, such as recited new claim 11, the high-concentration doped layer (11) becomes a barrier that prevents reverse injection of the holes in the base, and the recombination of the holes and electrons in the region near the connection of the emitter and the base can be prevented,

In the final Office Action, the Examiner asserts that, according to Jorke, since impurities are doped into the n^+ contact layer 5 (see column 3, lines 40-44) and the emitter layer 4 is provided below the n^+ contact layer 5 (see column 3, lines 35-39), the n^+ contact layer 5 corresponds with the high-concentration doped layer of the present invention. However, as currently amendment, the present invention of claim 1 is further different from Jorke for the following reasons:

According to the present invention, the emitter layer (5) is composed of at least two semiconductor layers (5a, 5b), and the high-concentration doped layer is interposed between

the two semiconductor layers (5a, 5b).

On the other hand, according to Jorke, although the emitter layer 4 is provided below the n^+ contact layer 5, the electrode E made of metal is provided on the n^+ contact layer 5 (see column 3, lines 48-49). Hence, the structure of the present invention is different from that of Jorke.

Moreover, a contact layer is generally provided to conduct electricity between an electrode made of metal and a semiconductor, and hence, it is not likely for the contact layer to be provided between two emitter layers. Therefore, Jorke does not disclose or suggest the feature of the present invention wherein the emitter layer (5) is composed of at least two semiconductor layers (5a, 5b), and the high-concentration doped layer is interposed between the two semiconductor layers (5a, 5b).

Further, since the contact layer is provided to conduct electricity between the electrode made of metal and the semiconductor, the contact layer of Jorke cannot be a barrier for carriers such as the holes. Hence, Jorke fails to disclose the effect of the present invention, such as preventing reverse injection of the holes in the base to the emitter using the n^+ contact layer 5 as a barrier for the holes.

Still further, the high-concentration doped layer (11) in the amended claim 1 of the present invention is also different from the δ p-doped layer 3 in Jorke. As shown in column 3, line 28 of Jorke, the δp-doped layer 3 is a base layer. On the other hand, since the high-concentration doped layer (11) in the present invention is interposed between the at least two semiconductor layers composing the emitter layer (5), the high-concentration doped layer (11) is different from the δp-dope layer 3 in Jorke.

For the foregoing reasons, amended claim 1 of the invention is distinguish over Jorke.

With respect to new claim 11, the claim recites the distance between the high-concentration doped layer and the base layer is 40 nm or less. On the other hand, Jorke discloses a laminated structure composed of the base layer 3 made of the δp-doped layer, the emitter layer 4 (thickness 50 nm, see column 3, line 38), the n^+ contact layer 5 (thickness l0 nm, see column 3, line 42) and the electrode E. Hence, according to Jorke, the distance between the n^+ contact layer 5 and the base layer 3 is 50 nm, which is the thickness of the emitter layer 4.

As mentioned above, if the distance between the high-concentration doped layer (11)

and the base layer (4) is more than 40 nm, the high-concentration doped layer (11) fails to become a barrier that prevents reverse injection of the holes in the base, and the holes and electrons recombine in the region near the connection of the emitter and the base. Since the distance between the n^+ contact layer 5 and the base layer 3 is 50 nm, there is a possibility that such recombination will occur.

On the other hand, since the distance between the high-concentration doped layer (11) and the base layer (4) in the new claim 11 is 40 nm or less, the high-concentration doped layer (11) becomes a barrier that prevents reverse injection of the holes in the base, and the recombination of the holes and electrons in the region near the connection of the emitter and the base can be prevented.

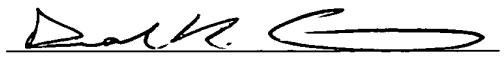
Since Jorke fails to disclose about the distance between the n^+ contact layer 5 and the base layer 3 being 40 nm or less, and the prevention of recombination, Jorke fails to disclose or suggest the feature and effect of the new claim 11. Hence, the new claim 11 is also distinguishable over Jorke.

In addition, Yamazaki, Swanson and Sze all fail to disclose the features and effect of the amended claim 1 and new claim 11 of the present invention. Hence, the present invention is distinguishable over these cited references.

In view of the amendment and argument set forth above, Applicants respectfully requests reconsideration and withdrawal of the pending §103(a) and § 112, first and second paragraph, rejections.

While the present application is now believed to be in condition for allowance, should the Examiner find some issue to remain unresolved, or should any new issues arise which could be eliminated through discussions with Applicants' representative, then the Examiner is invited to contact the undersigned by telephone in order that the further prosecution of this application can thereby be expedited.

Respectfully submitted,



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